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EMERGENCY CALLER ROUTING ANDHOSPITAL ROUTING SYSTEM USING AI & BLOCKCHAIN

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Abstract : The current emergency call system faces several challenges, including inefficiency, inaccuracy, lack of transparency, and security concerns. To address these limitations, an AI-powered emergency call system with blockchain technology is proposed. The system leverages AI to prioritize calls based on urgency and medical severity, route them to the most suitable hospital based on location, availability, and expertise, and handle multiple calls simultaneously, ensuring that no call goes unanswered. Blockchain technology ensures the system's security by providing an immutable and tamper-proof record of all calls, preventing unauthorized access or data manipulation. Additionally, blockchain grants access only to authorized personnel, ensuring that sensitive patient information remains protected. Furthermore, the proposed system can be integrated with existing emergency response systems, enabling a seamless transition to a more efficient, accurate, transparent, and secure emergency call system.

Keywords **- AI,Authorized Access, Blockchain,Data Integrity,Emergency Call System,Handling,Multiple Calls, Prioritization, Routing, Security**

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I. INTRODUCTION

Artificial intelligence (AI) and Blockchain Technology are two of the most transformative innovations of our time, each with the potential to revolutionize various industries and aspects of our lives. While they may seem like disparate concepts, AI and blockchain share a common thread: their ability to enhance efficiency, security, and trust in a rapidly evolving digital landscape.AI, with its ability to learn, adapt, and make decisions based on vast amounts of data, has permeated our daily lives, from powering virtual assistants to enabling medical breakthroughs. Blockchain, on the other hand, has emerged as a decentralized and secure ledger technology, underpinning cryptocurrencies and enabling trustless transactions without intermediaries and also provide privacy and security to the user data.

To addresses several critical challenges in the current healthcare system, including inefficient patient routing, limited access to timely care, inadequate coordination of care, and lack of patient empowerment we suggest creating a system which leverages AI to intelligently prioritize patients and recommend appropriate hospitals, while blockchain ensures the security and integrity of the system.

1.1 PROJECT IDEA

The current emergency call system is not efficient, accurate, transparent, or secure. It does not prioritize calls, it cannot handle multiple calls simultaneously, it is not secure, and it is not transparent. The proposed system uses AI and blockchain to address all of these limitations. It uses AI to prioritize calls and to route them to the most appropriate hospital. It can also handle multiple calls simultaneously and blockchain system to give access to only authorized personnel.

This project aims to develop a robust system that leverages artificial intelligence (AI) and blockchain technology to enhance the efficiency of emergency response services. The system will focus on intelligently sorting emergency calls based on the severity of

the situation and routing them to the most appropriate hospitals, ensuring timely and effective medical assistance. The goal of this project is to develop a robust system that leverages Artificial Intelligence (AI) and Blockchain technology to enhance the efficiency of emergency response services. The system will intelligently sort emergency calls based on the severity of the situation and route them to the most appropriate hospital, ensuring timely and effective medical assistance.

1.2 MOTIVATION OF PROJECT

We are motivated to pursue this project because of its potential to positively impact public health. According to the World Health Organization, 24,012 people die each day due to delay in getting medical assistance. This is a staggering statistic, and it is one that we believe can be reduced through the use of technology.

This project aims to develop a complex application that leverages machine learning, artificial intelligence, and blockchain to improve access to medical care. The application will be designed to provide users with timely and accurate information about their health, connect them with qualified healthcare providers.

We are personally passionate about healthcare, machine learning, AI, and blockchain. We believe that these technologies have the potential to revolutionize the way we deliver healthcare. We are also motivated by the opportunity to develop our expertise in making such complex applications and to practically make use of latest technologies and services. We believe that this project has the potential to make a real difference in the lives of people around the world. By improving access to medical care, we can help to reduce the number of people who die each day due to delay in getting medical assistance. In addition to the public health impact, this project is also motivating to us because it aligns with our academic and professional development goals. We are eager to develop our expertise in making complex applications and to practically make use of latest technologies and services. This project will give us the opportunity to do both.

II. LITERATURE SURVEY

- **Blockchain for Healthcare Management Systems: A Survey on Interoperability and Security**:

This research paper provides an extensive survey of the utilization of blockchain technology in healthcare management systems. It delves into the challenges faced by traditional healthcare systems in terms of data interoperability and security, emphasizing how blockchain can address these issues. The paper explores various use cases, such as electronic health records, medical supply chain management, and patient consent

management. It discusses the benefits of blockchain, including data immutability, decentralization, and enhanced security. Moreover, the paper may examine real-world examples of blockchain implementation in healthcare and the associated outcomes, and it might outline the key challenges and future prospects in this domain.

The paper begins by laying the groundwork for understanding the intersection of blockchain and healthcare management systems. It navigates through the fundamental concepts of blockchain, emphasizing its decentralized and distributed nature, which inherently aligns with the requirements of secure and interoperable healthcare systems.

The authors meticulously outline the key components of blockchain, such as blocks, consensus mechanisms, and smart contracts, that form the backbone of its application in healthcare.

Moving forward, the survey delves into the current state of blockchain adoption in healthcare. It explores various use cases ranging from electronic health records (EHRs) to supply chain management, illustrating how blockchain technology enhances data integrity, transparency, and traceability in healthcare processes. The authors examine successful implementations and highlight the tangible benefits accrued, such as reduced

fraud, improved data accuracy, and streamlined processes.

- **Identifying Security and Privacy Violation Rules in Trigger-Action IoT Platforms With NLP Models**

This paper focuses on the innovative application of Natural Language Processing (NLP) models to enhance security and privacy in Internet of Things (IoT) platforms using trigger-action mechanisms. It explains how trigger-action rules, often expressed in natural language, can pose security and privacy risks. The paper discusses the development and application of NLP models to automatically analyze these rules, identify potential violations, and suggest security improvements. It elaborates on the techniques and algorithms used for NLP analysis, showcases case studies, and highlights the implications for IoT security and privacy. The research aims to contribute to a safer and more privacy aware IoT ecosystem. Blockchain technology has emerged as a transformative force in various industries, and the healthcare sector is no exception. The paper titled ”Blockchain for Healthcare Management Systems: A Survey on Interoperability and Security” delves into the intricate nexus between blockchain, healthcare management systems, and the critical aspects of interoperability and security. This comprehensive survey not only explores the current landscape of blockchain applications in healthcare but also sheds light on the challenges and opportunities associated with ensuring seamless interoperability and robust security within these systems.

The healthcare industry, characterized by complex networks of stakeholders and sensitive patient data, faces numerous challenges that can be addressed by the innovative features of blockchain technology. The primary objectives of the paper are to provide a comprehensive overview of existing blockchain applications in healthcare management systems, analyze the interoperability challenges that arise in their implementation, and delve into the security considerations crucial for safeguarding patient information.

The paper begins by laying the groundwork for understanding the intersection of blockchain and healthcare management systems. It navigates through the fundamental concepts of blockchain, emphasizing its decentralized and distributed nature, which inherently aligns with the requirements of secure and interoperable healthcare systems.

- **Blockchain-based Formal Modeling of E-Hospital Emergency Management System**

The paper titled "Blockchain-based Formal Modeling of E-Hospital Emergency Management System" presents a cutting-edge approach to revolutionizing the formal modeling of emergency management systems within the context of electronic hospitals (E-Hospitals). By integrating blockchain technology into the formal modeling framework, the paper addresses critical challenges in emergency response systems, emphasizing transparency,

security, and efficiency. This comprehensive study explores the novel aspects, benefits, and potential applications of blockchain-based formal modeling in the domain of E-Hospital emergency management.

The paper commences by providing a contextual overview of the increasing reliance on electronic systems in hospital environments, especially during emergencies. Traditional emergency management systems often grapple with issues related to data integrity, interoperability, and secure information sharing. The integration of blockchain into the formal modeling process is introduced as a transformative solution to these challenges.

Blockchain's decentralized and tamper-resistant nature aligns seamlessly with the requirements of a robust emergency management system. The foundational concept of the paper revolves around the formal modeling of the E-Hospital emergency management system, employing blockchain as a fundamental building block. The authors delve into the specifics of formal modeling, elucidating its significance in providing a systematic and structured representation of the system's behavior, interactions, and protocols. By incorporating blockchain into this modeling paradigm, the paper aims to enhance the overall resilience and effectiveness of E-Hospital emergency management.

The benefits of blockchain-based formal modeling are multifaceted, as outlined in the paper. At the forefront is the aspect of data integrity. Blockchain's immutability ensures that once data is recorded, it cannot be altered or tampered with. This feature is pivotal in emergency situations where the accuracy of information, such as patient records, resource availability, and critical protocols, is paramount. The paper explores how blockchain's decentralized ledger serves as a reliable source of truth, mitigating the risk of misinformation and enabling a trustworthy representation of the emergency management system.

- **Social Media-Based Emergency Management to Organize Civilian Volunteers**

This research paper explores the utilization of social media platforms for coordinating and mobilizing civilian volunteers during emergency situations. It delves into the critical role that social media plays in connecting communities, disseminating information, and rapidly organizing volunteer efforts during crises. The paper examines the use of platforms like Twitter, Facebook, and others as effective tools for communication and volunteer recruitment. It may present case studies of successful social media-based emergency management, showcasing instances where this approach has led to efficient and timely responses to disasters. The research could discuss the challenges and best practices associated with social media-driven volunteer organization in the context of emergency management.

The advent of social media has revolutionized communication dynamics, offering unprecedented opportunities for real-time information dissemination and community engagement. In the context of emergency management, the paper begins by highlighting the increasing reliance on social media platforms as vital channels for information exchange during crises. Platforms such as Twitter, Facebook, and Instagram serve as not only sources of real-time updates but also as powerful tools for community mobilization.

One of the key focal points of the paper is the role of social media in organizing and coordinating civilian volunteers during emergencies. Traditional methods of volunteer recruitment and organization often face challenges in terms of speed, reach, and adaptability. Social media platforms provide a dynamic solution by enabling rapid dissemination of calls for volunteers, reaching a broad audience instantaneously. The paper explores successful case studies where social media played a pivotal role in rallying civilian support during disasters, showcasing the potential impact on emergency response timelines.

The study delves into the unique characteristics of different social media platforms and how emergency management strategies can be tailored to leverage these nuances. For instance, Twitter's real-time nature makes it ideal for quick updates and coordination, while Facebook's group functionalities facilitate community-building and information sharing in a more structured manner.

- **Blockchain Technology in Healthcare Big Data Management: Benefits, Applications and Challenges**

This research paper provides an extensive analysis of the integration of blockchain technology in healthcare big data management. It discusses the benefits of blockchain, including data immutability, transparency, and enhanced security, and how these features are particularly advantageous in managing vast amounts of healthcare-related data. The paper delves into various applications, such as electronic health records, clinical trials, and pharmaceutical supply chain management, demonstrating how blockchain enhances these areas. Additionally, it addresses the challenges and limitations associated with implementing blockchain in healthcare and offers insights into the future of this technology in the field.

The authors systematically unfold the benefits of integrating blockchain into healthcare big data management. At the forefront is data security and integrity. Blockchain's decentralized and cryptographic nature ensures that once data is recorded, it cannot be altered or tampered with. This immutability is a crucial factor in maintaining the integrity of patient records and other sensitive healthcare information. The paper delves into how this feature aligns seamlessly with the privacy and security requirements inherent in healthcare data. It discusses how patients can have more control over their health data, granting or revoking access as needed. This not only aligns with the principles of patient autonomy and privacy but also holds the potential to streamline data sharing among healthcare providers, leading to more cohesive and collaborative patient care.

The applications of blockchain in healthcare big data management are multifaceted, as outlined in the paper. Smart contracts, self-executing contracts with the terms of the agreement directly written into code, find a prominent place in the discussion.

Interoperability, a long-standing challenge in healthcare systems, is another area where blockchain shines. The paper elucidates how blockchain's distributed ledger can serve as a unified and standardized platform for data exchange among disparate healthcare systems.

Despite the promising benefits, the paper candidly addresses the challenges associated with implementing blockchain in healthcare big data management. Scalability, a perennial concern in blockchain technology, is discussed in the context of the growing volume of healthcare data. The authors explore potential solutions, including off-chain solutions and consensus mechanisms, to mitigate scalability issues and ensure the practical

viability of blockchain in large-scale healthcare systems.

- **Novel Approach of The Best Path Selection Based on Prior Knowledge Reinforcement Learning**

This paper introduces a novel approach for optimizing path selection, leveraging reinforcement learning and prior knowledge. It elaborates on the theoretical foundations of reinforcement learning and explains how it can be extended to incorporate prior knowledge to make more informed decisions. The research outlines the algorithms, techniques, and models used in this approach, emphasizing how it can be applied to diverse domains such as robotics, navigation, or decision-making systems. Real-world scenarios may be described to showcase the practical advantages of this novel approach, and potential future developments and applications may be discussed.

The core concept of the paper revolves around reinforcing the learning process by incorporating prior knowledge into the decision-making model. Reinforcement learning, a machine learning paradigm based on reward-based learning, has shown remarkable success in various applications. However, its effectiveness can be further amplified by leveraging existing knowledge about the environment, task, or system. The authors

propose a hybrid approach that amalgamates the strengths of reinforcement learning algorithms with the insights derived from prior knowledge.

The study delves into the technical aspects of the proposed approach, outlining the architecture of the reinforcement learning model and the mechanisms for integrating prior knowledge. It discusses how the model learns from both historical data and real-time experiences, continually adapting its decision-making strategy based on feedback and evolving conditions. This adaptive learning process is a key feature that distinguishes

the novel approach, allowing the system to respond dynamically to changes in the environment.

The application scenarios for the proposed approach are diverse and extend across multiple domains. In network routing, the paper illustrates how the hybrid model can optimize the selection of paths for data transmission. By considering factors such as network congestion, latency, and historical performance data, the model can adaptively choose the most efficient route, ensuring optimal data flow. The integration of prior knowledge becomes particularly valuable in scenarios where the network topology or performance characteristics are known in advance.

The robotic systems domain also benefits significantly from the proposed approach. Navigational decisions for autonomous robots often require a balance between exploration and exploitation. The hybrid model leverages prior knowledge about the environment to guide the robot's decision-making process, enabling more informed path selections. This becomes crucial in scenarios where the robot needs to navigate through dynamic or

partially known environments.

- **EACMS: Emergency Access Control Management System for Personal Health Record Based on Blockchain**

The paper titled "ECAMS: Emergency Access Control Management System for Personal Health Record Based on AI and Blockchain" introduces a groundbreaking system designed to enhance the security and accessibility of personal health records (PHRs) during emergencies. The convergence of Artificial Intelligence (AI) and Blockchain technologies forms the core of ECAMS, offering a robust framework for managing access controls to sensitive health data in crisis situations. This comprehensive study explores the novel aspects, benefits, and challenges associated with ECAMS, shedding light on its potential impact on healthcare emergency response systems.

The paper begins by contextualizing the importance of secure and expedited access to personal health information during emergencies. Traditional methods of managing access controls to PHRs often face challenges in terms of speed, efficiency, and the

ability to adapt to dynamic emergency scenarios. ECAMS aims to address these challenges by leveraging the complementary strengths of AI and Blockchain, creating a synergistic solution that ensures both security and rapid access to critical health data when it is needed most.

The foundational concept of ECAMS revolves around the integration of AI algorithms for intelligent access control management. The paper delves into the specifics of how AI contributes to the system, emphasizing the dynamic nature of access permissions during emergencies. AI-driven models can analyze contextual information, such as the severity of the emergency, the user's role, and the relevance of specific health data, to make informed and real-time decisions regarding access privileges. This adaptive access control mechanism ensures that the right information is accessible to the right individuals at the right time.

Blockchain technology, known for its decentralized and immutable nature, serves as the underlying infrastructure for ECAMS. The paper explores how the use of blockchain ensures the integrity and transparency of access logs. Every access request and permission change is recorded in a tamper-proof manner, providing an auditable trail of actions. This not only enhances the security of the system but also facilitates accountability and traceability in the management of PHR access during emergencies.

The benefits of ECAMS are multifaceted, as outlined in the paper. The AI-driven adaptive access control mechanism significantly improves the responsiveness of the system during emergencies. Traditional access control systems often rely on predefined rules, which may not be suitable for dynamic and unpredictable crisis situations.

- **A Secure and Scalable Data Source for Emergency Medical Care using Blockchain Technology**

The paper begins by highlighting the critical importance of quick and accurate access to medical data in emergency situations. Traditional data sources often face challenges related to security vulnerabilities, interoperability issues, and scalability constraints. The integration of blockchain into the emergency medical care framework is presented as a transformative solution, addressing these challenges and laying the groundwork for a more resilient and efficient system.

The foundational concept revolves around the establishment of a secure and scalable data source, with blockchain technology serving as the underlying infrastructure. The authors delve into the specifics of how blockchain's decentralized and cryptographic features contribute to enhancing the security and scalability of the emergency medical care data source. The decentralized ledger ensures that there is no single point of failure,

reducing the risk of unauthorized access and tampering. The immutability of the blockchain ledger ensures the integrity of medical data, a critical factor in emergency situations.

The benefits of incorporating blockchain technology into the emergency medical care data source are outlined in the paper. At the forefront is the aspect of data security. The authors discuss how blockchain's cryptographic principles and consensus mechanisms contribute to securing sensitive medical information. Patient confidentiality, secure communication channels, and protection against unauthorized access are pivotal aspects addressed by the integration of blockchain. The decentralized nature of the technology ensures that sensitive medical data remains confidential and is only accessible by authorized entities.

Scalability is another critical consideration addressed by the paper. In emergency situations, the volume of data generated and accessed can spike dramatically. The authors explore how blockchain's inherent scalability features, coupled with optimization techniques and consensus mechanisms, ensure that the system can handle a surge in data transactions without compromising performance. This scalability is crucial for ensuring the responsiveness of the emergency medical care data source in high-pressure situations.

Furthermore, the paper explores the transparency and traceability aspects afforded by blockchain technology. Every transaction, access request, or modification of medical data is recorded in a transparent and traceable manner. This not only facilitates accountability but also streamlines audit processes. The ability to trace the origin and evolution of critical medical decisions becomes invaluable in post-emergency analyses, continuous

improvement efforts, and maintaining a comprehensive medical history for patients.

- **Ambulance Vehicle Routing under Pandemic with Fuzzy Cooperative Game via Smart Contracts**

The paper begins by contextualizing the challenges faced by ambulance services during pandemics, where factors such as increased demand, resource constraints, and dynamic conditions amplify the complexities of vehicle routing. Traditional approaches to ambulance routing may struggle to adapt to the rapidly changing landscape of a pandemic, necessitating a more agile and cooperative framework. The integration of fuzzy cooperative game theory and smart contracts is proposed as a solution to enhance the efficiency and responsiveness of ambulance routing.

The foundational concept revolves around the application of fuzzy cooperative game theory to model the interactions between ambulance vehicles during a pandemic. Fuzzy logic, which accommodates uncertainty and imprecision, is employed to represent the dynamic and uncertain nature of pandemic-related data. The cooperative game theory framework enables ambulance vehicles to collaborate and optimize their routes based on the evolving conditions, acknowledging the interdependence and shared objectives of the vehicles in the fleet.

The paper delves into the specifics of how smart contracts on a blockchain facilitate the implementation of the proposed fuzzy cooperative game. Smart contracts, self-executing contracts with predefined rules written into code, provide a decentralized and

tamperproof platform for automating and enforcing the cooperative game among ambulance vehicles. The authors discuss how the transparency, security, and immutability of the blockchain contribute to the reliability and integrity of the ambulance routing system.

The benefits of the proposed approach are multifaceted, as outlined in the paper. At the forefront is the dynamic adaptability of the system to the unpredictable nature of pandemics. Fuzzy logic enables the model to handle imprecise and uncertain data, allowing ambulance vehicles to make informed decisions based on real-time information. The cooperative game framework ensures that vehicles collaborate rather than compete, optimizing the overall efficiency of the ambulance fleet in responding to the dynamically changing demands of a pandemic.

Moreover, the paper explores the aspect of resource optimization through the fuzzy cooperative game. The model considers factors such as the availability of medical resources, the severity of cases, and the geographic distribution of incidents.

Furthermore, the paper highlights the flexibility of the proposed approach in adapting to different pandemic scenarios. Fuzzy logic allows the model to be customized and calibrated based on the specific characteristics of different pandemics, accommodating variations in the nature and impact of different infectious diseases.

III. METHODOLOGY

The proposed system can be developed through a structured and risk-managed approach that encompasses four main phases: project initiation, project planning, project execution, and project monitoring and control.

Project initiation phase: The project's scope, objectives, and deliverables are clearly defined, a diverse and experienced project team is assembled, stakeholders are identified and engaged, and a formal project charter is created.

Project planning phase: This involves gathering user requirements from various stakeholders, designing a comprehensive and scalable system architecture, developing detailed technical specifications, creating a project schedule, and establishing a risk management plan.

The project execution phase: The proposed software components are implemented using appropriate programming languages and frameworks, rigorous testing is conducted throughout the development process, the system is deployed in a phased manner, comprehensive training and documentation are provided, and a continuous improvement process is established.

The project monitoring and control phase: This involves utilizing project management tools to track progress and manage resources, generating regular status reports to communicate progress and identify potential issues, implementing a change management process to evaluate and prioritize changes, continuously monitoring identified risks and implementing mitigation strategies, and regularly evaluating the system's performance against defined metrics.

This methodology provides a structured and risk-managed approach to the development of the proposed system, increasing the likelihood of its successful implementation and positive impact on the healthcare landscape.

IV. SYSTEM ARCHITECTURE AND DESIGN

4.1 System Architecture

- User Initialization**:** The process begins when a user dials the call emergency number, which is typically a universal number like 112 or 911. This number is assigned to the system and recognized by the network as a priority call that requires immediate attention.
- Location Identification and Emergency Type Classification: The system's artificial intelligence (AI) algorithm analyzes the caller's speech patterns, background noises, and other contextual clues to classify the type of emergency. This classification helps prioritize the call and dispatch the patient to the most appropriate hospital.
- Blockchain Authentication: The system is protected and authenticated by blockchain. The admin could authorize and whitelist users to which he want to give the system to handle too.

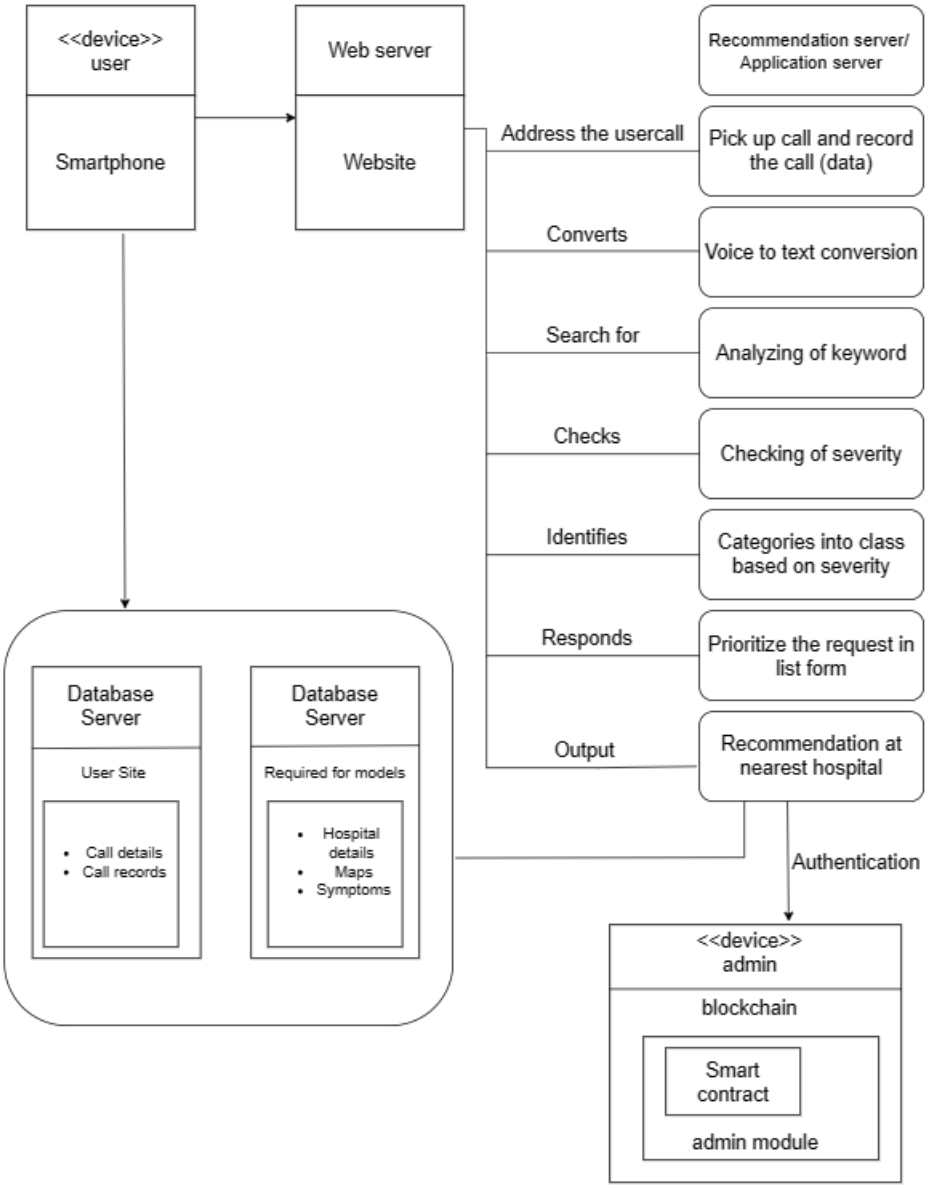

Figure 1: System Architecture

4.2 Use Case Diagram

The use case diagram illustrates the functionalities and interactions of the Emergency Caller Routing and Hospital Routing System. The primary components includes:

- Analyze Patient Information: The caller's location, emergency type and vital information about the problem is analyzed.
- Prioritize Severity: The caller's severity is predicted.
- Recommend Hospital: The appropriate hospital is recommended by the algorithm.

Actors

- AI Algorithm: The Algorithm plays a vital role in analyzing the patient condition and recommending hospital
- Patient/Helper: External actor interacting with the system, utilizing its features for seamless emergency service
- Backend Admin: Monitors and Reviews the decisions made by the system

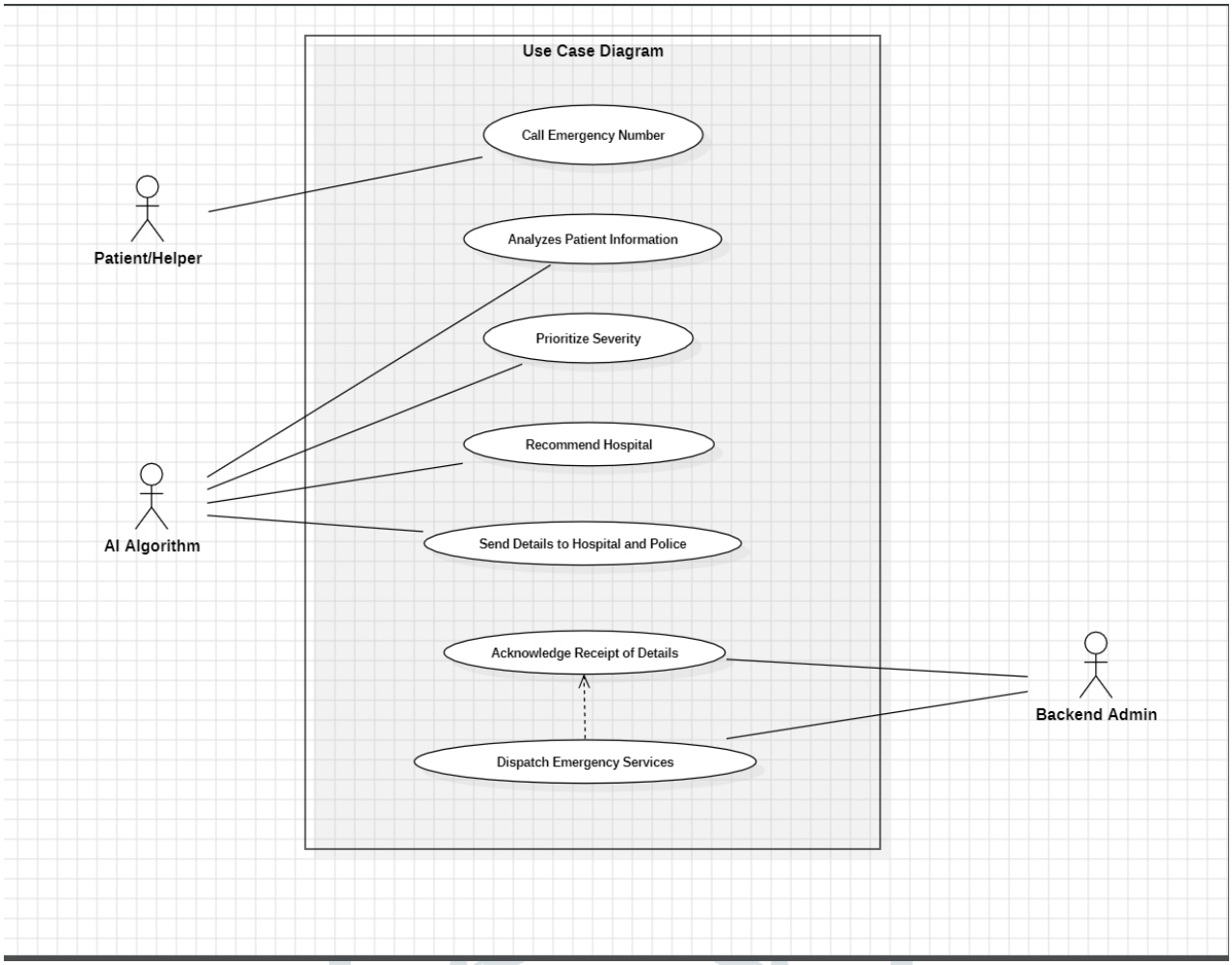

Figure 2: Use Case Diagram

V. APPLICATIONS

The application of an Emergency Caller Sorting and Hospital Routing System using AI and Blockchain has numerous benefits for optimizing emergency healthcare services. Here are the key applications and advantages:

1. Efficient Call Sorting: AI algorithms can quickly analyze and categorize incoming emergency calls based on severity, location, and medical condition. This ensures that critical cases receive immediate attention, leading to faster response times and potentially saving lives.

2. Optimized Resource Allocation: - The system can route patients to hospitals based on their specific medical needs and the hospital's available resources. This prevents overcrowding at certain facilities and ensures that patients receive appropriate care.

3. Reduced Response Times: By automatically selecting the nearest and most suitable hospital for each case, response times can be significantly reduced. This is crucial for time-sensitive medical emergencies.

4. Data Security and Privacy: Blockchain technology is used to securely store and manage patient data, ensuring privacy and preventing unauthorized access. This instills trust in patients and healthcare providers.

5. Improved Decision-Making: AI can assist healthcare professionals by providing real-time data and insights on patient conditions and hospital availability. This aids in making informed decisions during emergencies.

VI. CONCLUSION

In conclusion, the "Emergency Caller Sorting and Hospital Routing System" represents a groundbreaking solution that stands to revolutionize emergency healthcare services. By seamlessly integrating Artificial Intelligence (AI) and Blockchain technology, this system adeptly addresses the inherent challenges in traditional emergency response systems, and, in doing so, it presents a transformative approach to enhancing the efficiency, security,and quality of emergency healthcare.

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